CLAIMS

What is claimed is:

1. A modular power converter comprising:

a thermal support at least partially defining an electric reference plane and configured to receive and circulate a coolant stream for extraction of heat;

a substrate secured to the thermal support and cooled during operation by the coolant stream; and

a power electronics circuit directly secured to and cooled by the substrate, the power electronics circuit being configured for generating output signals resulting from power conversion, the power electronic circuit generating heat during operation that is at least partially extracted by the coolant stream via the substrate.

2. The modular power converter of claim 1, wherein the power electronics circuit is bonded to the substrate.

3. The modular power converter of claim 1, wherein the thermal support is a single-piece support.

4. The modular power converter of claim 1, wherein the thermal support is a multi-piece support.

5. The modular power converter of claim 1, wherein the thermal support includes at least one extension for supporting and cooling additional circuitry.

6. The modular power converter of claim 1, wherein the power electronics circuit forms an inverter.

7. The modular power converter of claim 1, wherein the power electronics circuit forms a matrix converter.

8. The modular power converter of claim 1, further comprising a control circuit secured on and cooled by the thermal support.

9. The modular power converter of claim 1, further comprising line conductors for directing incoming power to the power electronics circuit and load conductors for directing outgoing power from the power electronics circuit.

10. The modular power converter of claim 9, wherein the line conductors are disposed on a first side of the support.

11. The modular power converter of claim 10, comprising a fluid inlet and a fluid outlet for receiving the coolant stream, and wherein the fluid inlet and outlet ports are disposed on a second side of the support.

12. The modular power converter of claim 10, wherein the load conductors are disposed on a second side of the support opposite the line conductors.

13. The modular power converter of claim 1, further comprising an energy storage circuit coupled to the power electronics circuit and secured to and cooled by the thermal support.

14. The modular power converter of claim 1, further comprising a driver circuit for applying the drive signals to the power electronics circuit, the driver circuit being secured to and cooled by the thermal support.

15. A modular power converter comprising:

a thermal support for a circuit, the support comprising a substrate having fluid inlet and outlet ports and a circulation path coupled between the inlet and outlet ports, the inlet and outlet ports being configured to transmit a coolant for circulation through the circulation path;

an interface plate configured to support a power electronics circuit, the interface plate being configured for mounting to the support adjacent to the coolant circulation path for extraction of heat from the interface plate during operation; and

a power electronics circuit configured for power conversion supported on the interface plate;

wherein the support at least partially defines an electrical reference plane, a mechanical support, and a thermal extraction path for the circuit.

16. The modular power converter of claim 15, wherein the power electronics circuit is bonded to the interface plate.

17. The modular power converter of claim 15, wherein the thermal support is a single-piece support.

18. The modular power converter of claim 15, wherein the thermal support is a multi-piece support.

19. The modular power converter of claim 15, wherein the thermal support includes at least one extension for supporting and cooling additional circuitry.

20. The modular power converter of claim 15, wherein the power electronics circuit forms an inverter.

21. The modular power converter of claim 15, wherein the power electronics circuit forms a matrix converter.

22. The modular power converter of claim 15, further comprising a control circuit secured on and cooled by the thermal support.

23. The modular power converter of claim 15, further comprising line conductors for directing incoming power to the power electronics circuit and load conductors for directing outgoing power from the power electronics circuit.

24. The modular power converter of claim 23, wherein the line conductors are disposed on a first side of the support.

25. The modular power converter of claim 24, wherein the fluid inlet and outlet ports are disposed on a second side of the support.

26. The modular power converter of claim 24, wherein the load conductors are disposed on a second side of the support opposite the line conductors.

27. The modular power converter of claim 15, further comprising an energy storage circuit coupled to the power electronics circuit and secured to the thermal support.

28. The modular power converter of claim 15, further comprising a driver circuit for applying the drive signals to the power electronics circuit, the driver circuit being secured to and cooled by the thermal support.

29. A modular power converter comprising:

a controlled power electronics circuit including solid state switches configured to convert incoming power to controlled outgoing power;

a control circuit coupled to the power electronics circuit and configured to generate control signals for control of the solid state switches; and

a liquid cooled support at least partially defining an electrical reference plane and on which at least the power electronics circuit is directly secured, the fluid cooled support including inlet and outlet ports for a cooling fluid and an internal fluid conduit for directing flow of cooling fluid adjacent to the power electronics circuit for removal of heat therefrom.

30. The modular power converter of claim 29, wherein the power electronics circuit is bonded to an interface plate mounted to the support.

31. The modular power converter of claim 29, wherein the support is a single-piece support.

32. The modular power converter of claim 29, wherein the support is a multi-piece support.

33. The modular power converter of claim 29, wherein the support includes at least one extension for supporting and cooling additional circuitry.

34. The modular power converter of claim 29, wherein the power electronics circuit forms an inverter.

35. The modular power converter of claim 29, wherein the power electronics circuit forms a matrix converter.

36. The modular power converter of claim 29, wherein the control circuit is secured on and cooled by the fluid cooled support.

37. The modular power converter of claim 29, further comprising line conductors for directing incoming power to the switches and load conductors for directing outgoing power from the switches.

38. The modular power converter of claim 37, wherein the line conductors are disposed on a first side of the support.

39. The modular power converter of claim 38, wherein the fluid inlet and outlet ports are disposed on a second side of the support.

40. The modular power converter of claim 38, wherein the load conductors are disposed on a second side of the support opposite the line conductors.

41. The modular power converter of claim 29, further comprising an energy storage circuit coupled to the power electronics circuit and secured to the support.

42. The modular power converter of claim 29, further comprising a driver circuit for applying the drive signals to the power electronics circuit, the driver circuit being secured to and cooled by the support.

43. A method for converting electrical power comprising:

directly securing a plurality of solid state switches to an interface;

securing the interface to a thermal support defining an electrical reference plane and configured to receive a coolant stream via inlet and outlet ports;

applying drive signals to the switches to generate controlled output power; and

circulating the coolant stream through the support to extract heat from the switches.

44. The method of claim 43, wherein the solid state switches are bonded to the interface.

45. The method of claim 43, wherein the solid state switches are bonded to a single interface.

46. The method of claim 43, wherein the interface is secured to the thermal support by welding.

47. The method of claim 43, wherein the solid state switches form an inverter circuit.

48. The method of claim 43, wherein the solid state switches form a matrix converter.

49. The method of claim 43, wherein incoming power is applied to the solid state switches along a first side of the support and output power is drawn from the switches along the first side of the support.

50. The method of claim 49, wherein the inlet and outlet ports are disposed along sides of the support other than the first side.

51. The method of claim 50, wherein the inlet and outlet ports are both disposed along a second side of the support.

52. A modular power converter comprising:

means for directly securing a plurality of solid state switches to an interface;

means for securing the interface to a thermal support defining an electrical reference plane and configured to receive a coolant stream via inlet and outlet ports;

means for applying drive signals to the switches to generate controlled output power; and

means for circulating the coolant stream through the support to extract heat from the switches.